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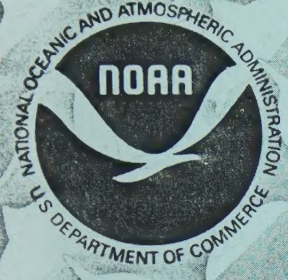

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STUDIES OF MARINE MAMMALS AT THE FARALLON ISLANDS 1983 - 1985

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Stuart Johnston and Jerry Nusbaum

ADMINISTRATIVE REPORT LJ-86-17C

STUDIES OF MARINE MAMMALS AT THE FARALLON ISLANDS

1983 - 1985

Harriet R. Huber, Laurie Fry, Ane Rovetta,
Stuart Johnston and Jerry Nusbaum

Point Reyes Bird Observatory
4990 Shoreline Highway
Stinson Beach, CA 94970

Final Report
to

National Marine Fisheries Service
Southwest Fisheries Center

18 November 1985

This report was prepared by Harriet R. Huber, Laurie Fry, Ane Rovetta, Stuart Johnston and Jerry Nusbaum under contract No. 84ABC-00041 for the National Marine Fisheries Service, Southwest Fisheries Center, La Jolla, California. The statements, findings, conclusions and recommendations herein are those of the authors and do not necessarily reflect the views of the National Marine Fisheries Service. Wayne Perryman of the Southwest Fisheries served as Contract Officer's Technical Representative for this contract.

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ABSTRACT

Observations of pinnipeds and cetaceans on or near the South Farallon Islands are reported for the fifteenth consectuive year; including six years under contract to the Marine Mammal Commission and six years under contract to the National Marine Fisheries Service. Five species of pinnipeds and seven species of cetaceans were censused and observed from 1 September 1983 to 31 May 1985. The winter 1983-84 elephant seal breeding season was reported in Huber et al. (1985).

Cetacean observations include migrating gray whales and humpback whale sightings and sightings of blue whale, minke whale, killer whale, Dall's porpoise and a possible Risso's dolphin. The frequency of humpback and blue whales was much less than in 1982 or 1983 whereas the sightings of minke whales were much greater than in the past.

In 1984 the peak count of northern sea lions was 207; 6 pups were born including one born prematurely. One premature pup was also born in 1985. That year there were 6 full-term pups and the high count was 155. One of the pups was born on West End. In July 1984 we counted 6783 California sea lions, an increase of 21% over the previous high count in 1983. Numbers decreased in 1985 compared to 1983 and 1984. One pup was observed in 1984. Sightings of northern fur seals decreased in 1984 and 1985. High counts of harbor seals were 62 in 1984 and 50 in 1985. A pup was seen in May 1985; it may or may not have been born on the Farallones.

The numbers of elephant seals declined during the 1985 breeding season: females decreased by 18%, males by 25% and pup production was down 20% from 1984 to 359 pups. Return rates for both males and females were significantly lower and natality was reduced in 1985. We speculate that these changes are temporary and related to the warm waters observed in 1983 and 1984. Because of the mild, stormless winter, pup mortality was reduced to 19%, although the percentage of stillbirths doubled to 9%. The average age of females pupping on the Farallones has risen to 6.5 years. We tagged 404 elephant seals in 1985, primarily pups.

INTRODUCTION

Many reports describing the wildlife of the Farallon Islands, California, have appeared since 1854 (see review by Ainley and Lewis 1974; Ainley et al. 1977a), and most have briefly mentioned marine mammals. The first real censuses of Farallon pinnipeds were conducted by Bonnot; and are summarized in Bonnot et al. (1938).

The northern elephant seal (Mirounga augustirostris) has recently established a breeding population at the Farallones; two other species, the harbor seal (Phoca vitulina) and the California sea lion (Zalophus californianus), may be etablishing breeding populations. Visits by a fourth species, the northern fur seal (Callorhinus ursinus), which probably was a former breeding species, are increasing in frequency. This provides a unique opportunity to study comparative colonization processes by pinnipeds. A fifth species, northern sea lion (Steller) Eumetopias jubatus) has declined in number, yielding another opportunity to learn about changes in wild populations. Biologists from the Point Reyes Bird Observatory (PRBO) are present year round on the Farallones, and these opportunities are not being ignored. PRBO looks forward to maintaining a station on Southeast Farallon indefinitely, thus to continue collection of long-term data sorely needed to understand short- and long-term fluctuations in marine mammal populations. Results of studies from 1971 to 1983 are reported in Ainley et al. (1977a, 1977b, 1978) and Huber et al. (1979, 1980, 1981, 1982, 1983, 1985). This report covers information collected from September 1983 to May 1985, except the 1984 elephant seal winter breeding season which appears in Huber et al. (1985). Partial

support for these studies has come from the Marine Mammal Commission (1974-1980), National Marine Fisheries Service (1978-1983), and National Marine Sanctuary Office (1984-1985). Continued support is in question.

THE FARALLON ISLANDS

Southeast Farallon and West End (Figure 1), compose the South Farallon Islands or South Farallones which, with several other close-by large rocks, comprise about 44 hectares (100 acres). The North Farallones, three large rocks, lie 8 km to the north. The South Farallones are 43 km west of San Francisco, California, and 32 km from the closest land, Point Reyes directly north and Bolinas Point to the northeast. The islands are on the brink of the continental slope with deep oceanic waters lying immediately westward and shallow inshore waters lying eastward. The islands are positioned at the eastward edge of the cold, productive waters of the California Current.

Few other places in the eastern North Pacific provide habitat for the number and variety of wildlife that occur at the Farallones: eleven breeding species of seabirds with a combined population of over 250,000 constitute the largest seabird breeding colony in the contiguous United States; more than 325 species of birds have visited the islands; and five species of pinnipeds haul out there, at least four, and perhaps all, of which have bred on the islands. Sea otters also are said to have bred at the Farallones.

During the 1800's and through the early 1900's the Farallones were subjected to much disturbance by humans. Sealers exterminated fur seals,

elephant seals, and sea otters and hunted sea lions for food (Scammon 1874; Riddell 1955; Doughty 1971). In 1856 a lighthouse was established and has been maintained continuously since. For most of that period at least four families, with their associated pets and mules, lived on the South Farallones year round. In the 1850's, a commercial egg company began an unregulated harvest of seabird eggs that continued until the early 1900's with apparently little regard for other wildlife. During later years the presence of the U.S. Coast Guard deterred visitors. The Farallones, with the exception of the South Farallones, have been a Federal Wildlife Refuge since 1909. In 1969 the South Farallones were included. Because of the islands' relative remoteness, not much active protection had been practiced until PRBO personnel set up a station in April 1968. When the Coast Guard automated its equipment in 1972, PRBO entered into a cooperative agreement with the U.S. Fish and Wildlife Service under which PRBO conducts research, helps coordinate the activities of other researchers, protects island wildlife from human disturbance, and helps maintain the island's facilities. The marine bird and mammal populations have responded dramatically to the gradually lessening disturbance over the past decade (Ainley and Lewis 1974; PRBO unpubl.).

METHODS

With the exception of elephant seal censuses, little attention was paid the pinnipeds during the first few years of PRBO occupation. In 1971 and 1972, occasional counts of sea lions were made and in mid-1973 regular censuses began. From June 1974 through August 1980, censuses were

conducted under contract to the Marine Mammal Commission. Since September 1978 censuses have also been carried out under contract to the National Marine Fisheries Service.

Elephant seals have been counted regularly from blinds or from other points near their preferred haul out areas since 1970, daily during the breeding season and at least once a week during the rest of the year. From 1976 to 1983, elephant seals were counted twice-weekly during spring molt and fall haul out when the greatest number of animals is present. During the seabird breeding season (from the end of May to 1 August) we counted the elephant seals from Lighthouse Hill (elevation 109 m) to minimize disturbance to both birds and seals. This census point lowers counts slightly, as portions of the seals' usual hauling out spots are not visible from Lighthouse Hill. However, few seals are present during most of that period and we consider the error relatively insignificant. Whenever possible the tag numbers of animals tagged on the Farallones and other islands were read with binoculars and recorded. Untagged animals were often recognized by individual characteristics (scars, etc.), records of which are kept on file.

The number of harbor seals hauled out varies greatly from one day to another. Whenever observed, their numbers have been recorded; since 1973 a conscious effort has been made to find them. Beginning in 1976, they were included in weekly censuses which are conducted at low tide in order to get maximum counts.

Censuses of sea lions were made between 1300 and 1600 hours. Twelve all-day watches in which sea lions were counted revealed that maximum

numbers hauled out during these hours. Weekly counts were made from Lighthouse Hill and other vantage points using a 25x spotting scope. These counts included animals in the water. Since California sea lions tagged on the Channel Islands began showing up in 1982, an effort to read tags consistently has been made.

Northern fur seals were recorded whenever observed.

Beginning in the fall of 1970, cetaceans were recorded when sighted. During the course of other activities, the ocean to the south and west of the island was watched intermittently for at least 2 hours daily, weather permitting. Cetacean sightings made by different observers (with binoculars and/or 25x spotting scopes) were totaled at the end of the day and duplicate sightings eliminated.

SPECIES ACCOUNTS

Cetaceans

California gray whale (Eschrichtius robustus)

During the winter of 1983-1984, the gray whale southern migration began in mid-December and peaked in early January when 59 individuals passed the Farallones in one day. The first northern migrant appeared at the end of January; the northern migration was essentially over by the end of March (Table 1). The following year (1984-1985), the southward migrants first appeared at the end of December; their numbers peaked with 62 animals on 14 January. The return migration began in mid-February and ended by the last week in March (Table 1). Both north and south migration dates were similar to previous years. Likewise, as in other recent years, at least 3 gray

whales summered in the vicinity of the Farallones in 1984 and 1985. There were very few summer sightings during 1983.

Humpback whale (Megaptera novaeangliae)

Beginning in 1977, humpback whales have been observed both spring and fall from the Farallones, and, since 1978, throughout the summer months as well. In 1984 the number of sightings dropped sharply with only 5 whales seen during the whole year, and none were sighted during the spring (Table 2). In 1985 humpbacks were again seen in the spring (Table 2). Since 1977 what appear to be cow-calf pairs have been observed. This was true even in 1984, despite reduced sightings.

Other Cetaceans

During 1984-1985 there were only two sightings of blue whales (Balaenoptera musculus) (Table 3). This is in marked contrast to 1982 and 1983 when blue whales were seen frequently from the Farallones by PRBO observers and west of the Farallones by sportfishermen and sightseeing boats. Both humpback whales and blue whales were seen with much greater frequency in 1982 and 1983 than before or since. In general, there were reduced sightings of all cetaceans during 1984. The only species seen with increased frequency was the minke whale (Balaenoptera acutorostrata) (Table 3). Other cetacean sightings in 1984-85 include killer whale (Orcinus orca), Dall's porpoise (Phocoenoides dalli), and a possible Risso's dolphin (Grampus griseus; Table 4).

Pinnipeds

Northern (Steller) sea lion (Eumetopias jubatus)

The northern sea lion population at the Farallones fluctuates seasonally with highest numbers recorded during the breeding season. The pattern was the same in 1984 and 1985 (Fig. 2). High counts were 207 animals in 1984 and 144 in 1985 (Table 5).

In 1984, 6 pups were born: one premature pup on 22 March and 5 full-term pups between 15 and 20 June. One of the full-term pups died as did the premature pup. Natality and pup mortality in 1985 were similar to the previous year (Table 6). The one premature pup in 1985 was born 23 April; full-term pups were born between 11 June and 27 June. In both 1984 and 1985, northern sea lions were observed on West End, and in 1985 a pup was born there. West End was a major haul out area prior to the 1940's, but until 1984 northern sea lions have not used it in recent years.

California sea lion (Zalophus californianus)

During the warm-water phenomenon of 1983, unprecedented numbers of California sea lions were observed on the Farallones. High numbers continued in 1984 with peak counts of 6783 on 28 July, an increase of 21% over the previous high count in 1983. One pup was born on 21 June. Many dead animals with empty stomachs were seen in the spring, an indication that the shortage of prey, evidenced by breeding failure of marine birds and mammals in 1983, was not yet over. An epidemic of leptospirosis affected California and northern sea lions along the mainland coast during the fall of 1984. The disease was also in evidence at the Farallones where

animals with external symptoms were seen fall and winter.

Numbers decreased in 1985 compared to numbers observed in 1983 and 1984 (Table 7, Fig. 3). In 1985 no California sea lion pups were seen.

Northern fur seal (Callorhinus ursinus)

When PRBO observations of marine mammals began in 1970, northern fur seals were seldom seen. Now they are seen regularly summer and fall. In 1984, the adult male seen on the Farallones during the summer since 1978 was present 12 June to 21 July. A small animal from San Miguel Island (with unread pink tags) was seen for a few days in August. Occurrence of fur seals decreased in 1985: the only sightings were those of a subadult male between August 3 and 18 September. For the first time since 1978, the naturally marked adult male who annually has spent up to 6 weeks on the Farallones was not seen.

Harbor seal (Phoca vitulina)

Sightings of harbor seals increased dramatically during the past 15 years (Fig. 4). In 1984, a high count of 62 animals occurred in August; the winter 1985 high count was 50 in February (Table 8). In 1984, no pups were seen during the breeding season. In 1985, a pup was seen on 25 May; it may or may not have been born on the Farallones. A summary of Farallon harbor seal sightings and a comparison with numbers of harbor seals seen on the coast is contained in Allen et al. (ms).

Northern elephant seal (Mirounga augustirostris)

Northern elephant seals are recovering from near extinction by sealers during the 1800's. The population dropped to less than 100 animals at the turn of the century and is now estimated at 70,000. The first immigrant was seen on the Farallones in 1959; breeding began 13 years later.

Beginning in 1983, the number of elephant seals on the Farallones peaked during the winter breeding season instead of the spring molt or fall haulout as in past years (Fig. 5). This change in the seasonal pattern is another stage in the evolution of the Farallon colony and may be an indication that the survival rate of immatures (the primary age class present in the spring and fall haulouts) is decreasing. High counts during the breeding season were 855 in 1984 and 738 in 1985 (Table 9).

Breeding season 1985. In general, during the 1985 breeding season, numbers of elephant seals declined. The number of males decreased by 25% over the previous year (Table 10); the number of females present on the Farallones decreased by 18% to 397 (Table 11); and pup production was down 20% from 1984 to 359 pups (Table 11). We speculate that these changes are associated with the warm waters of El Nino observed in 1983-1984 rather than a permanent change in the Farallon population. The chronology of the breeding season was similar to previous years, although the last pup was born a week earlier than in the past 6 years (Table 12), and the first bull departed the island 5 to 6 weeks earlier than before. In 1985 we tagged 404 elephant seals, primarily pups (Table 13). The proportion of breeding animals born on the Farallones increased by 15% between 1984 and 1985,

while the proportion from Ano Nuevo and San Miguel decreased by 15%. The amount of immigration from San Nicholas remained the same (Table 14).

Females. The average age of tagged females pupping on the Farallones continues to increase; it is now 6.5 years (Table 15). The oldest pregnant female is 15 years old. The average age of Farallon-born females is 5.7 (Table 16). The percentage of Farallon-born females pupping doubled between 1984 and 1985 to 9.4%.

El Nino appears to have had long-term effects on the Farallon population. Return rates for females were lower after 1983 both for individuals returning the following year and for those returning in any subsequent year. Between 1976 and 1982 the percent of females returning the following year ranged from 64 to 78%, and the percent that returned some subsequent year ranged from 74 to 82%; after 1983 only 58% returned the following year and only 68% returned in any subsequent year. These rates in 1983 were significantly lower than in 1981 (test of proportions $c=2.61$, $p<.02$; $c=2.13$, $p<.05$) or in 1982 (test of proportions $c=3.15$, $p<.01$; $c=2.38$, $p<.02$), Table 17). Other indications that 1984 and 1985 were unusual are the reduced reproductive rates, a higher proportion of non-pregnant females present in the breeding season and changes in natality. Reproductive rates for tagged females followed for 3 years ranged from 0.88 to 0.92 between 1981 and 1983 but in 1984 reproductive rates decreased to 0.84 and in 1985 to 0.80. The percent of non-pregnant females observed during the breeding season rose to 7% and 8%, respectively, for 1984 and 1985. This is in contrast to 2% for the previous 4 years

(1980-1983). Natality of known-age females also changed during 1984 and 1985. Between 1975 and 1983, we found natality reached unity by age 9 (Table 18). However, because many older females skipped the 1984 or 1985 breeding seasons, during those years natality of 1.0 was achieved only by females 11 years and older. We expected the stress of reduced prey to affect younger animals but we found that it affected "prime females", age 7 to 10, as well. It will take another year or two of resightings of 3 and 4 year-olds to determine just how much the younger age classes were affected. The differences in natality for 5 to 10 year-olds before and after El Nino were highly significant (paired t-test, $t=4.75$, $df=5$, $p<.01$; Table 18).

Adult males. We attribute changes in the male breeding population in 1984 and 1985 to the lingering effects of El Nino as well. In 1984 the rate of increase of males slowed to 5% from an average of 30% in previous years. In 1985 the number of males decreased by 25% (Table 10): the proportion of bulls present remained the same, the proportion of SA4's increased, and the proportion of 5 to 7 year-olds decreased indicating that whatever caused the decrease affected younger animals more than older ones. The return rate of individuals also decreased. In 1983, 50% of all tagged males present in 1982 returned. In 1984 the return rate was down slightly to 47%, but in 1985 the return rate decreased significantly to 32% overall test of proportions $c=3.23$, $p<.01$, Table 10). In looking at the return rate of the various age classes, the difference in return rates of bulls, SA4's and SA3's were not significant (test of proportions $c=.648$ $p<.5$, $c=1.67$ $p<.10$, $c=1.77$ $p<.10$, respectively). The return rate of SA2's,

however, was significantly lower in 1985 (test of proportions $c=2.65$ $p<.02$), indicating that the stress of El Nino hit younger animals harder than older animals.

Although the return rate of males was significantly lower between 1984 and 1985, there was no significant difference in arrival dates, departure dates, or time spent on the island for 12 males present in all three breeding seasons, 1983 to 1985.

Breeding success of males on the Sand Flat is found in Table 20. In the early years when less than 100 females were present, the dominant male was involved in 80 to 95% of copulations observed. As has been true in recent years, in 1985, less than 40% of the copulations were accomplished by the dominant male. He was a ten-year-old male, seen on the Farallones since 1980.

Pup mortality. Mild weather, reduced density and older age of females giving birth, reduced pup mortality dramatically in 1985 to 19% (67/359). This is the lowest pup mortality to weaning in 8 years (Table 21). The nearly stormless winter also decreased pup death by drowning from 31% in 1984 to 22% in 1985. Because of the decreased density and older average age of females present, the number of crushed and abandoned pups also decreased. The percent of stillborn pups increased from less than 2% in the years 1975 to 1983 to 4% in 1984 and doubled again to 9% in 1985 (Table 21).

When we compared pup mortality in different areas between 1984 and 1985, we found lower mortality during 1985 in all areas (Table 22).

Several areas, which in stormy years like 1983 have nearly 100% pup mortality (NL, GG and MV), had significantly lower mortality in 1985 ($t=4.34$, $p<.001$) despite increased numbers of pups born in these areas (Table 22). For the second year the number of pups born on Shell Beach surpassed the number of pups born on the Sand Flat, the major pupping area since the colony's inception.

Tag Resighting

Following birth of the first pup in 1972, all pups surviving to weaning have been tagged (except in 1979 because of permit complications). Immature animals haul out in largest numbers during the spring and fall. Comparing the fall haul out of Farallon-born animals in 1982, 1983 and 1984, we found that yearlings were present only in July, 2-year-olds began arriving in August, 3-year-olds in September, and 4-year-olds in October. The same pattern holds true for immatures tagged on San Miguel and San Nicolas Islands and seen on the Farallones. Equal numbers of males and females haul out through age 3, regardless of island of birth, but by age 4 significantly more males haul out. This is explained by the fact that 80% of females are breeding by age 4 and breeding females haul out in winter. The spring molt is similarly partitioned; yearlings are present in early March, 2-year-olds arrive in mid-March, 3-year-olds in April, and 4-year-old males in May. Four-year-old parous females arrive earlier in the season: their arrival date during molt depends on when they pupped during the breeding season and whether they nursed a pup to weaning. Females that do not nurse a pup to weaning spend significantly less time at sea ($t=7.34$, $df=33$, $p<.001$).

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Table 1. Number of Gray whales seen from South Farallon Islands, 1983-1985.

Date	Minimum Number	Direction of Travel N	Direction of Travel S	Remain Near Island
1983				
Sep 2	1			
7	1			
12	1			1
14	2			
15	1			
16	1			1
20	1			1
21	1			
27	1			1
Dec 17	4		4	
18	1		1	
22	1		1	
26	1			
27	6		5	
28	25		20	
29	25		25	
30	1			
31	26		25	1
1984				
Jan 1	32		27	1
2	59		48	1
3	5		2	
4	20		20	
5	3		1	2
8	21		15	
9	4		3	
11	8		7	
12	11		9	1
13	27		26	
14	28		25	1
15	7		7	
16	8		7	1
17	9		6	3
18	2			
19	8		5	1
20	3		2	1
21	1		1	
22	5		2	
23	3			3

Date	Minimum Number	Direction of Travel N	Direction of Travel S	Remain Near Island
1984				
Jan 24	7		4	2
25	1			1
27	3		3	
28	5		3	2
29	4	2	1	1
30	1		1	
Feb 1	3		3	
7	1			1
10	1	1		
17	1			
18	2	2		
19	1			
20	15	15		
26	9	9		
27	16	10		2
28	31	31		
Mar 2	3	3		
4	40	40		
5	26	24		
6	8	8		
7	10	8		1
8	11	9		1
9	9	9		
10	11	10		
11	6	3		
12	5	5		
15	2			
19	2	2		
23	2	2		
24	1			1
27	2			1
29	1			1
30	1			1
Apr 2	1			
3	1	1		
4	2			2
5	1			1
6	1			

Date	Minimum Number	Direction of Travel N	Direction of Travel S	Remain Near Island
1984				
Apr 9	1			1
10	1			
11	2			
13	1			1
14	1			1
15	1			1
16	1			1
17	1			1
19	1			
26	1			1
27	1			
28	1			
29	6			
May 4	1			
5	1			
6	1			
7	1			1
8	1			
11	1			
16	1			
17	2			
19	1			
22	1			
23	1			
25	1			
27	1			1
28	1			1
31	1			1
				1
Jun 1	1			
3	2			
4	1			
5	1			1
6	2			
7	1			

Date	Minimum Number	Direction of Travel N	Direction of Travel S	Remain Near Isl
1984				
Jun 8	1			
9	1			
11	1			
12	1			
13	1			
14	1			
15	2			2
16	2			2
17	1			
18	1			
19	1			
20	2			
21	2			2
22	1			1
23	1			1
24	1			
25	2			
26	1			
28	1			1
29	1			1
30	1			1
Jul 1	1			1
2	1			
4	1			1
5	1			
6	1			1
7	2			2
8	1			1
9	1			1
10	1			1
11	1			1
12	1			
13	2			2
14	2			2
15	2			

Date	Minimum Number	Direction of Travel N	Direction of Travel S	Remain Near Island
1984				
Jul 16	2			2
17	1			1
18	1			1
19	3			3
20	2			
21	1			
22	1			
23	2			2
25	2			2
26	1			
27	1			1
28	1			
29	1			1
30	2			2
31	2			2
Aug 1	1			1
2	1			1
3	1			1
4	1			1
5	2			2
6	2			2
7	2			2
8	1			
9	1			
10	2			
11	3			
12	3			
13	2			2
14	1			1
15	2			2
17	1			
18	2			2
19	2			2
20	2			2
21	1			1
22	2			2
23	1			
24	1			1
25	1			1
28	2			
29	1			
30	1			
31	1			
1984				
Sep 1	4			
2	1			
3	1			
4	1			
5	1			
8	1			1
10	1			
11	1			1
25	3			
Oct 29	1			
30	1			1
31	1			1
Nov 1	1			1
7	1			
8	1			1
13	1			
15	1			
16	1			1
17	1			1
19	1			1
22	1			1
23	1			1
24	1			
25	1			1
29	1			1
30	1			
Dec 1	1			1
2	1			
3	1			
7	1			
10	1			
11	1			
14	1			1
15	1			
17	1			
19	1			
20	1			
21	1			
22	1			
23	1			1
24	1			1

Date	Minimum Number	Direction of Travel N	Direction of Travel S	Remain Near Island
1984				
Dec 27	1			
28	1			
29	1			
30	4		3	1
31	2			
1985				
Jan 1	16		14	1
2	10			
3	4			
4	1			
5	3			
6	5			
7	1			1
8	18		17	1
9	20		19	1
10	26		25	1
11	7		5	1
12	45		43	2
13	4		3	1
14	62		58	
15	22			
16	31		29	2
17	7		6	1
18	15		11	4
19	23		22	1
22	28		28	
23	4		4	
27	5		5	
28	1			
29	1			
30	3		3	
Feb 2	1			
3	1			
5	1			1
6	1			1
7	1			1
12	1	1		
23	4			
24	2	2		
28	4	4		

Date	Minimum Number	Direction of Travel N	Direction of Travel S	Remain Near Isla
1985				
Mar 1	1	1		
3	2	2		
5	2	2		
7	2	2		
8	25	25		
9	9	8		1
10	1			
11	6	5		
15	1			
17	1			
18	1			1
19	1			1
20	11			1
21	5	5		
23	11	9		2
24	6	5		
25	1			1
26	1			1
28	1			1
30	1			1

Table 2. Sightings of Humpback whales from South Farallon Islands, 1983-1985.

Date	Number Observed	Remarks
1983		
Sept 1	1	1 mile SW, travelling S
5	1	1/4 mile SW, travelling N
1984		
July 6	2	very active breeching
Aug 5	1	1/2 mile S, travelling S
7	1	SE of island
Sept 5	2	1 large, 1 smaller, breeching
6	2	1 large, 1 smaller, flipper slapping
1985		
May 17	3	1 mile SW

Table 3. Sightings of Minke whales from South Farallon Islands, 1983-1985.

Date	Number Observed	Remarks
1983		
Sept 17	1	travelling W
1984		
June 23	1	6 miles E
Sept 25	1	outside Fisherman's Bay
Nov 1	1	1/2 mile SE, travelling S

Table 4. Sightings of other cetaceans from South Farallon Islands, 1983-1985.

Date	Number Observed	Remarks
1983		
Oct 10	2	Orca--1 mile W, not adult males
25	1	possible Risso's dolphin
27	1+	Dall's porpoise
30	3	Orca--2 male, 1 female near N. Farallones
Nov 4	2-3	Blue whale, moving S
1984		
Oct 11	1	probable Blue whale, travelling SW
1985		
Feb 27	15+	dolphin sp.

Table 5. Weekly censuses of northern (Steller) sea lions on South Farallon Islands, 1983-1985.

Date	Total Number	Adult Male	Subadult Male	Probable Female	Immature	Yearling	Pup
1983							
Sept 10	31			21	8		2
15	45			27	10		8
22	55			32	17		6
29	42		1	23	19		1
Oct 7	67			39	23		5
14	70			55	11		4
20	50			37	5		8
27	31			14	13		4
Nov 12	104			50	27		27
17	72			37	10		25
26	90			63		27	
Dec 2	93		2	68	20		3
15	107			93	14		
27	49			29	5		15
1984							
Jan 2	43			24	10	9	
9	35			21	3	11	
17	48			34	6	8	
27	41			28	5	8	
Feb 9	44			28	4	12	
16	38			25	5	8	
26	32			21	4	7	
Mar 6	31			19	5	7	
22	55			43	10	2	
30	30			14	14	2	
Apr 6	37			25	9	3	
12	70		2	46	7	15	
27	103			75	28		
May 4	52			30	22		
17	121	4	10	72	35		
25	145	7	8	81	49		
31	146	11	13	90	32		
June 15	117	8	12	45	53		
21	149	15	8	94	30		2
28	142	12	8	60	59		2

Table 5 (cont'd)

Date	Total Number	Adult Male	Subadult Male	Probable Female	Immature	Yearling	Pup
1984							
July 6	68	6	12	21	26		3
11	113	10	10	41	48		4
28	84	4	7	34	37		4
Aug 10	46		1	24	15		4
17	46		4	27	10		5
23	23			11	7		5
31	24			19	5		
Sept 6	26			15	11		
13	29			15	14		
20	35			24	8		3
27	23			13	4		6
Oct 4	31			18	8		5
11	34			18	6		10
18	103			60	26		17
25	36			29	6		
Nov 1	98		1	78	19		
8	93			52	34		7
16	92			46	34		12
23	128			70	23		35
29	142			84	28		30
Dec 6	207			93	46	14	54
14	202			95	47	17	43
20	208			110	26	14	58
28	134			91	8		35
1985							
Jan 3	54			27		27	
10	33			21		12	
17	40			24		16	
24	41			31		10	
Feb 4	62			38		24	
11	46			35		11	
14	43			29		14	
25	29			19		10	
28	35			27		8	
Mar 8	43			29		14	
14	43			31		12	
21	121			49		72	
31	144		1	77		66	

Table 5 (cont'd)

Date	Total Number	Adult Male	Subadult Male	Probable Female	Immature	Yearling	Pup
1985							
Apr 5	133			95		38	
14	75		2	54		19	
19	53			33		20	
May 2	48		1	33		14	
9	41	2	3	20		16	
16	84	4	4	53		23	
24	96	8	7	50		31	
30	113	7	8	41		44	

Table 6. Reproductive success of female northern (Steller) sea lions on Southeast Farallon Island, 1973-1985.

Year	Highest number of females present	Number of pups born	Percent natality	Number of premature births	Pup deaths - other causes	Percent mortality
1973	73	9	12	3	-	33
1974	110	10	9	4	-	40
1975	98	19	19	4	5	47
1976	98	14	14	5	1	43
1977	111	27	24	11	-	41
1978	103	18	17	10	-	56
1979	96	15	15	3	3	40
1980	91	26	29	14	2	61
1981	86	17	20	11	-	64
1982	99	12	12	7	1	67
1983	79	10	13	7	2	90
1984	90	6	7	1	1	33
1985	80	7	8	1	1	28

Table 7. Weekly censuses of California sea lions on South Farallon Islands, 1983-1985.

1983		1984		1984	
Sept 10	3891	May 4	2207	Dec 6	1436
15	3717	17	2146	14	1386
22	3521	25	2813	20	1375
29	3227	31	3731	28	1184
Oct 7	2748	June 15	2823	1985	
14	3086	21	1085		
20	2099	28	1136	Jan 3	450
27	2487			10	777
		July 6	2297	17	656
Nov 12	3137	11	1609	24	945
17	3223	21	4638+		
26	3225	28	6783	Feb 4	1485
				11	1574
Dec 2	2093	Aug 10	5660	14	1367
15	3098	17	3901	25	1397
27	1715	23	2789	28	1695
		31	2755		
1984				Mar 8	1374
		Sept 6	2414	14	2556
Jan 2	1764	13	1761	21	1775
9	1099	20	1159	31	3581
17	1404	27	2123		
27	2263			Apr 5	4187
		Oct 4	2288	14	2810
Feb 9	2142	11	1287	19	1477
16	2781	18	2677		
26	2144	25	2241	May 2	1541
				9	1656
Mar 6	2319	Nov 1	2126	16	1734
22	2700	8	1354	24	1499
30	2356	16	1325	30	1078
		23	1627		
Apr 6	1301	29	1956		
12	1324				
27	1645				

Table 8. Weekly censuses of harbor seals on South Farallon Islands, 1983-1985.

1983			1984			1985		
Sept	1	41	May	4	26	Jan	3	34
	6	57		17	38		14	48
	11	54		25	36		16	38
	22	49		31	34		27	38
Oct	5	54	June	8	28	Feb	1	47
	14	53		15	32		4	40
	18	64		28	41		10	40
	25	33					16	50
			July	6	51		28	35
Nov	4	38		11	46			
	15	46		20	34	Mar	8	43
	17	64		28	20		14	33
	26	61					31	46
			Aug	7	34			
Dec	2	47		15	41	Apr	6	34
	15	31		25	62		21	28
	28	67		31	41		26	20
							29	32
1984			Sept	6	57			
				14	52	May	1	23
Jan	2	41		24	56		9	25
	11	39		29	57		16	22
	23	51					29	32
			Oct	4	55			
Feb	4	41		18	45			
	15	45		23	41			
	26	59		31	48			
Mar	4	41	Nov	1	51			
	22	35		8	37			
	27	51		23	24			
	30	61		29	23			
Apr	3	60	Dec	16	43			
	12	43		20	39			
	22	43		28	48			
	27	46						

Table 9. Weekly censuses of northern elephant seals on South Farallon Islands, 1982-83.

1983		1984		1984	
Sept 10	220	May 4	742	Dec 6	318
15	209	17	601	14	304
22	288	25	418	20	283
29	298	31	423+	28	239
Oct 7	521	June 15	149+	1985	
14	493	21	104+		
20	666	28	99+	Jan 3	248
27	466			10	342
		July 6	81+	17	504
Nov 12	322	11	105+	24	683
17	433	21	43+		
26	469	28	85+	Feb 4	738
				11	692
Dec 2	323	Aug 10	95+	14	633
15	191	17	77+	25	453
27	250	23	62+	28	406
		31	120+		
1984				Mar 8	360
		Sept 6	175	14	338
Jan 2	334	13	184	21	345
9	442	20	300	31	254
17	531	27	378		
27	855			Apr 5	383
		Oct 4	387	14	437
Feb 9	702	11	481	19	611
16	668	18	572		
20	499	25	630	May 2	266+
				9	356
Mar 6	364	Nov 1	542	16	459
22	425	8	464	24	327
30	621	16	384	30	268
		23	313		
Apr 6	467	29	258		
12	590				
27	573				

Table 10. Age classes of male elephant seals during the breeding season on South Farallon Islands, 1976-1985.

Age Class	SA2 (5 yrs)	SA3 (6-7 yrs)	SA4 (7-8 yrs)	Bull (8+ yrs)	Total # Males	% Change Over Previous Year
1976	10 (46%)	6 (27%)	0	6 (27%)	22	
1977	18 (50%)	15 (42%)	1 (3%)	2 (6%)	36	+63%
1978	26 (54%)	16 (33%)	4 (8%)	2 (4%)	48	+33%
1979	34 (47%)	19 (26%)	13 (18%)	6 (8%)	72	+50%
1980	39 (41%)	32 (34%)	13 (14%)	11 (12%)	95	+32%
1981	62 (47%)	33 (25%)	21 (16%)	15 (11%)	131	+38%
1982	66 (40%)	38 (23%)	35 (21%)	24 (15%)	163	+24%
1983	89 (46%)	44 (23%)	37 (19%)	24 (12%)	194	+19%
1984	68 (33%)	61 (30%)	32 (16%)	44 (21%)	205	+ 5%
1985	41 (27%)	43 (28%)	35 (23%)	34 (22%)	153	-25%

Table 11. A summary of animals involved in elephant seal breeding seasons on the South Farallon Islands, 1972-1985.

Year	Number of bulls*	Number of breeding males	Number of females present	Number of pups born	Percent change	Pups weaned
1972	0	1	2	1		1
1973	0	1	3	2	+100%	2
1974	7	1	19	17	+750	5
1975	8	3	37	35	+105	28
1976	6	5	62	60	+71	56
1977	2	10	111	104	+73	84
1978	2	18	143	133	+30	99
1979	6	25	194+	184+	+38	128
1980	11	22	236+	232+	+26	136
1981	15	22	300+	292+	+26	172
1982	24	33	375+	367+	+26	255
1983	24	36	487+	475+	+29	325
1984	44	38	479	447	-06	301
1985	34	28	391	359	-20	292

* as defined in Table 10.

Table 12. Breeding chronology for elephant seals on South Farallon Islands, 1972-1985.

Year	Bulls		Cows		Pupping
	Arrival	Departure	Arrival	Departure	
1972	6 Feb	16 Feb	20 Jan	12 Feb	20 Jan
1973	13 Jan	16 Feb	13-14 Jan	10-12 Feb	17-19 Jan
1974	27 Nov-18 Jan	28 Jan-23 Mar	2-28 Jan	9 Feb-16 Mar	15 Jan-6 Feb
1975	26 Nov-17 Jan	13 Feb-15 Mar	25 Dec-4 Feb	27 Jan-11 Mar	31 Dec-10 Feb
1976	1-22 Dec	24 Feb-11 Mar	20 Dec-4 Feb	21 Jan-7 Mar	28 Dec-10 Feb
1977	19-27 Dec	10-13 Mar	20 Dec-17 Feb	18 Jan-14 Mar	25 Dec-18 Feb
1978	6-23 Dec	10-21 Mar	19 Dec-12 Feb	18 Jan-13 Mar	23 Dec-15 Feb
1979	26 Nov-4 Jan	28 Feb-25 Mar	14 Dec-13 Feb	20 Jan-17 Mar	20 Dec-17 Feb
1980	25 Nov-1 Jan	25 Feb-24 Mar	18 Dec-20 Feb	22 Jan-26 Mar	27 Dec-26 Feb
1981	16 Nov-22 Dec	13 Feb-25 Mar	18 Dec-17 Feb	17 Jan-19 Mar	24 Dec-18 Feb
1982	15 Nov-30 Dec	17 Feb-23 Mar	20 Dec-22 Feb	16 Jan-18 Mar	24 Dec-24 Feb
1983	8 Nov-4 Jan	23 Feb-27 Mar	18 Dec-14 Feb	17 Jan-12 Mar	21 Dec-18 Feb
1984	23 Nov-19 Jan	14 Feb- 3 Apr	13 Dec-17 Feb	17 Jan-12 Mar	22 Dec-21 Feb
1985	25 Nov-19 Jan	6 Jan- 6 Apr	13 Dec- 8 Feb	16 Jan-16 Mar	19 Dec-13 Feb

Table 13. Number of elephant seals tagged on South Farallon Islands, 1972-1985.

Year	Adult Male	SA4	SA3	SA2	SA1	Adult Female	Imm.	Pups	Total Number Tagged
1972								1	1
1973								2	2
1974			1					5	6
1975	2		7	5		11		28	53
1976			2	3		16		56	77
1977			7	21	10	49	11	83	181
1978		2	13	22	20	62	34	98	251
1979		1	4	28	7	31	5	54	130
1980	1	8	21	33	28	51	5	137	284
1981	3	10	21	62	17	55	10	172	350
1982	2	6	16	39	10	45	6	248	372
1983	15	19	29	81	4	102	3	302	555
1984	14	20	23	69	4	91	2	301	524
1985	15	16	19	26	4	32	0	292	404
									3190

Table 14. Island of birth for tagged elephant seals on Southeast Farallon Island during Breeding Season, 1981-1985.

	FARALLON			ANO NUEVO			SAN MIGUEL			SAN NICHOLAS			
	M	F	Total %	M	F	Total %	M	F	Total %	M	F	Total %	Total
1981	8	11	19%	11	33	45%	12	18	30%	3	3	6%	99
1982	7	18	19%	10	39	37%	18	36	40%	3	3	4%	134
1983	9	22	22%	8	47	38%	21	27	34%	4	4	6%	142
1984	8	20	25%	5	33	35%	15	23	35%	3	3	5%	110
1985	5	34	40%	4	25	30%	15	10	25%	4	1	5%	98

Table 15. Known-age elephant seal cows pupping on South Farallon Islands, 1975-1984.

Year	3 yr old	4 yr old	5 yr old	6 yr old	7 yr old	8 yr old	9 yr old	10 yr old	11 yr old	12 yr old	13 yr old	14 yr old	Average age
1975	1	4	1										4.0
1976	0	6	2	1									4.4
1977	3	5	4	2	1								4.5
1978	6	7	4	5	1	0							4.5
1979	12	8	7	4	3	1	1						4.6
1980	4	23	11	3	3	3	0	1					4.8
1981	8	12	22	10	5	1	2	0	1				5.2
1982	*0	31	16	21	10	5	1	1	0	1			5.5
1983	0	*10	24	13	21	13	4	1	1	0	1		6.3
1984	2	8	*8	20	8	17	6	3	1	0	0	1	6.5

* Because of permit complications, few pups were tagged in 1979.

Table 16. Known-age Farallon-born cows pupping on South Farallon Islands, 1978-1985.

Year	3 yr old	4 yr old	5 yr old	6 yr old	7 yr old	8 yr old	9 yr old	10 yr old	11 yr old	Average age
1978	1									
1979	0	2	1							4.3
1980	0	2	4	1						4.8
1981	1	4	2	3	1					4.9
1982	*0	7	5	3	2	1				5.1
1983	0	6	5	4	3	3	1			5.7
1984	0	6	4	3	2	3	1	1		5.9
1985	1	12	8	4	2	2	2	2	1	5.7

* Because of permit complications, few pups were tagged in 1979.

Table 17. Return rates of female elephant seals on South Farallon Islands, 1975-1983.

YEAR	Number of tagged animals	Number return following year	Number return any subsequent year
1975	10	8	9 **
1976	40	28	30
1977	77	51	57
1978	101	69	75
1979	99	63	76
1980	88	61	66
1981	101	76 *	81 *
1982	89	70 **	73 *
1975-1982	605	426 *	467 *
1983	125	74	85

* $p<.05$
** $p<.01$

Table 18. Natality of known-age females on the Farallon Islands, 1975 to 1985.

Age	1975-1983	n	1984-1985	n	1975-1985	n
1 yr	0.00	215				
2 yr	0.00	190				
3 yr	0.194	165				
4 yr	0.755	143				
5 yr	0.831	107	0.739	23	0.815	130
6 yr	0.871	70	0.818	33	0.854	103
7 yr	0.878	49	0.821	28	0.857	77
8 yr	0.956	23	0.785	28	0.862	51
9 yr	1.00	8	0.833	18	0.885	26
10 yr	1.00	3	0.888	9	0.916	12
11-15 yr	1.00	4	1.00	6	1.00	10

Table 19. Return rates of male elephant seals to South Farallon Islands, 1983-1985.

Age		1983	1984	1985
BULL	No. present previous year	23	24	43
	No. return	11	10	17
SA4	No. present previous year	35	37	32
	No. return	20	20	11
SA3	No. present previous year	38	44	60
	No. return	19	23	21
SA2	No. present previous year	65	89	63
	No. return	32	39	15
ALL	No. present previous year	161	192	198
	No. return	82	92	64

Table 20. Breeding success of male elephant seals at Sand Flat, 1985.

Tag Number	Age	Number of Copulations Observed	% of Total Observed Copulations	# of 1st Observed Copulations	Period of Copulations
5440	B	129	35	48	13 Jan - 5 Mar
5472	B	59	16	21	2 Feb - 5 Mar
DEL	B	24	6	4	4 Feb - 18 Feb
5308	B	23	6	1	8 Feb - 1 Mar
4718	B	19	5	1	4 Feb - 6 Mar
4007	SA4	18	5	4	27 Jan - 23 Feb
3717	B	16	4	3	26 Jan - 2 Mar
4723	SA3	11	3	4	3 Feb - 18 Feb
4705	SA4	11	3	1	4 Feb - 14 Feb
4712	B	10	3	2	4 Feb - 27 Feb
1972	SA4	8	2		10 Feb - 14 Feb
3670	SA4	6	2		2 Feb - 12 Feb
4711	SA3	5	1	2	4 Feb - 14 Feb
4827	SA3	5	1		18 Feb - 22 Feb
3742	SA3	4	1		6 Feb - 21 Feb
4738	B	3	<1	2	4 Feb - 23 Feb
806	B	3	<1	1	7 Feb - 15 Feb
958	B	3	<1		5 Mar - 6 Mar
4995	SA3	2	<1		20 Feb - 23 Feb
1404	SA4	2	<1		25 Feb
4755	SA3	2	<1		27 Feb
4769	SA4	2	<1		13 Feb - 23 Feb
4799	SA2	1	<1	1	7 Feb
4815	SA3	1	<1		12 Feb
4749	SA4	1	<1		14 Feb
4728	B	1	<1		26 Feb
2411	B	1	<1		28 Feb
4825	SA2	1	<1		6 Mar
		371			

Table 21. Elephant seal pup mortality to weaning 1974-1985 on South Farallon Islands.

Year	Number of pups born	Number of pups died	Percent mortality	Causes of Death						
				Crushed by male	Abandoned, bitten	Drowned	Fell off cliff	Stillborn	Other	Unknown
1974	17	12	71	0	8	2	0	1	1	0
1975	35	7	20	2	0	3	1	1	1	0
1976	60	4	7	1	1	1	0	1	0	0
1977	104	20	19	5	7	6	0	2	0	0
1978	133	34	26	7	7	0	3	1	2	5
1979	184	56	30	10	14	5	8	1	1	17
1980	232	96	41	20	11	21	18	1	1	24
1981	292	120	42	16	11	21	17	2	1	42
1982	367	112	31	17	7	17	11	2	0	58
1983	475	150	32	25	11	30	10	3	0	71
1984	447	147	33	26	15	47	14	6	0	39
1985	359	67	19	9	9	15	3	6	1	24

Table 22. A comparison of pup mortality to weaning in selected areas on South Farallon Islands, 1983 to 1985.

	Southeast Farallon					West End		
	MB	SF	NL	MTSF	GG	MV	1HB	SB
1983								
Number of pups born	21	178	6	19	2	10	58	167
% mortality	54%	33%	100%	11%	100%	90%	35%	31%
1984								
Number of pups born	24	127	32	6	22	9	58	159
% mortality	78%	23%	72%	17%	32%	22%	31%	17%
1985								
Number of pups born	18	92	18	9	24	5	54	134
% mortality	39%	12%	55%	0	66%	0	11%	14%

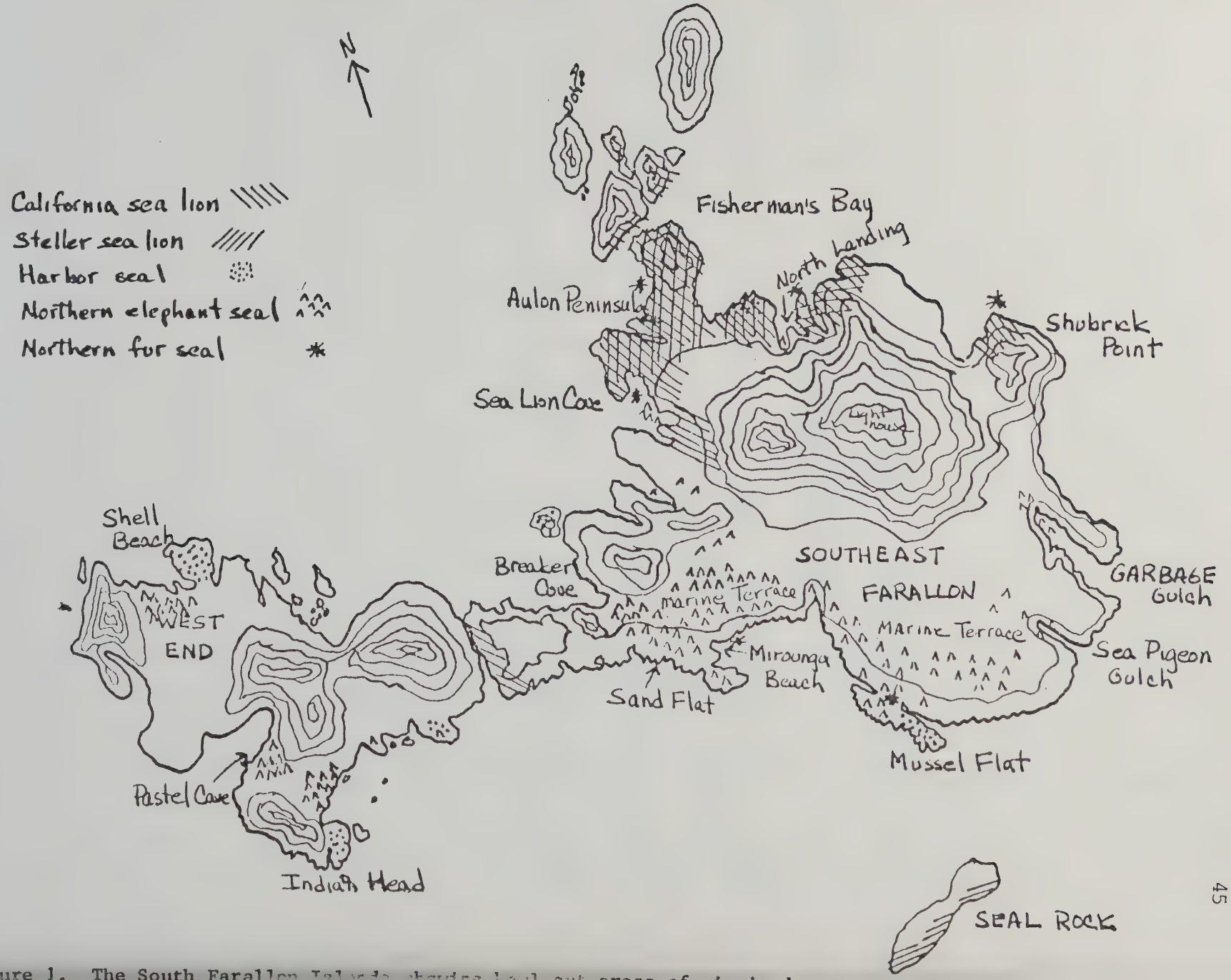


Figure 1. The South Farallon Islands, showing land-use areas mentioned in the text.

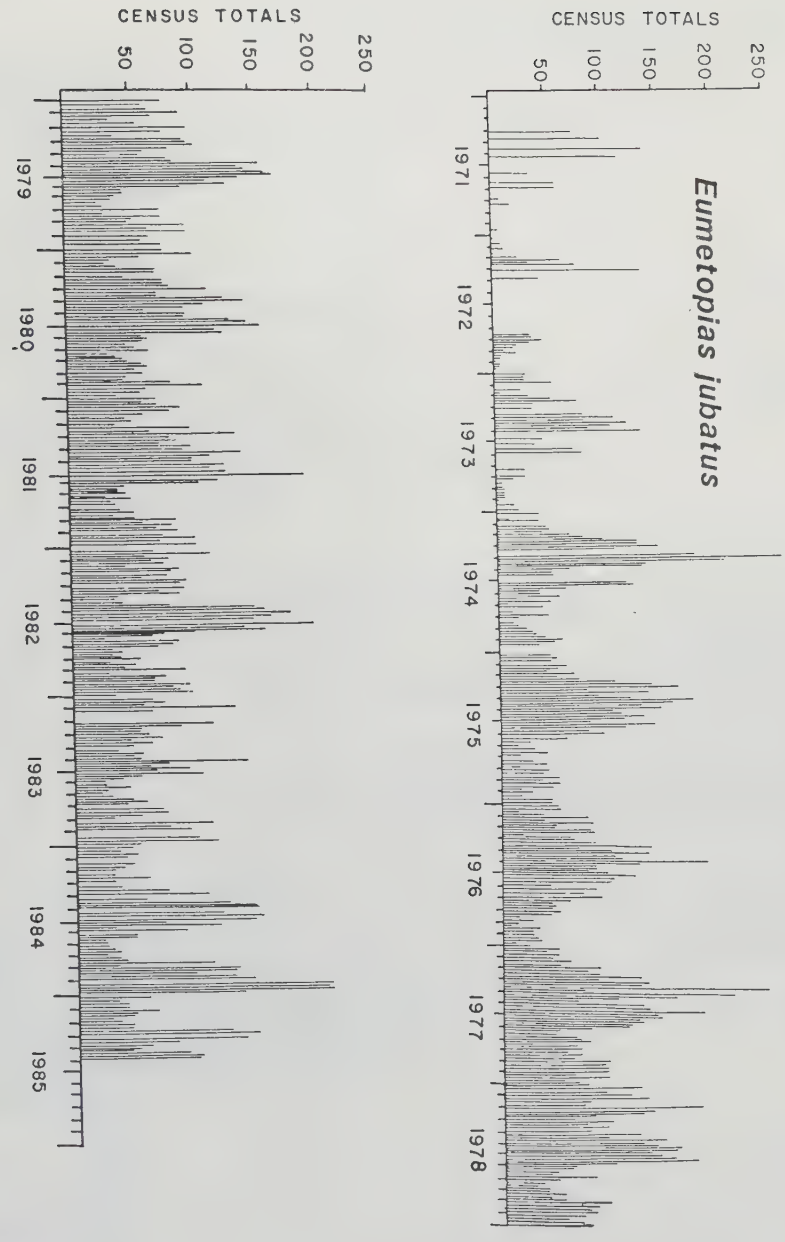


Figure 2. The occurrence of northern (Steller) sea lions (Eumetopias jubatus) at the Farallones, 1971-1985.

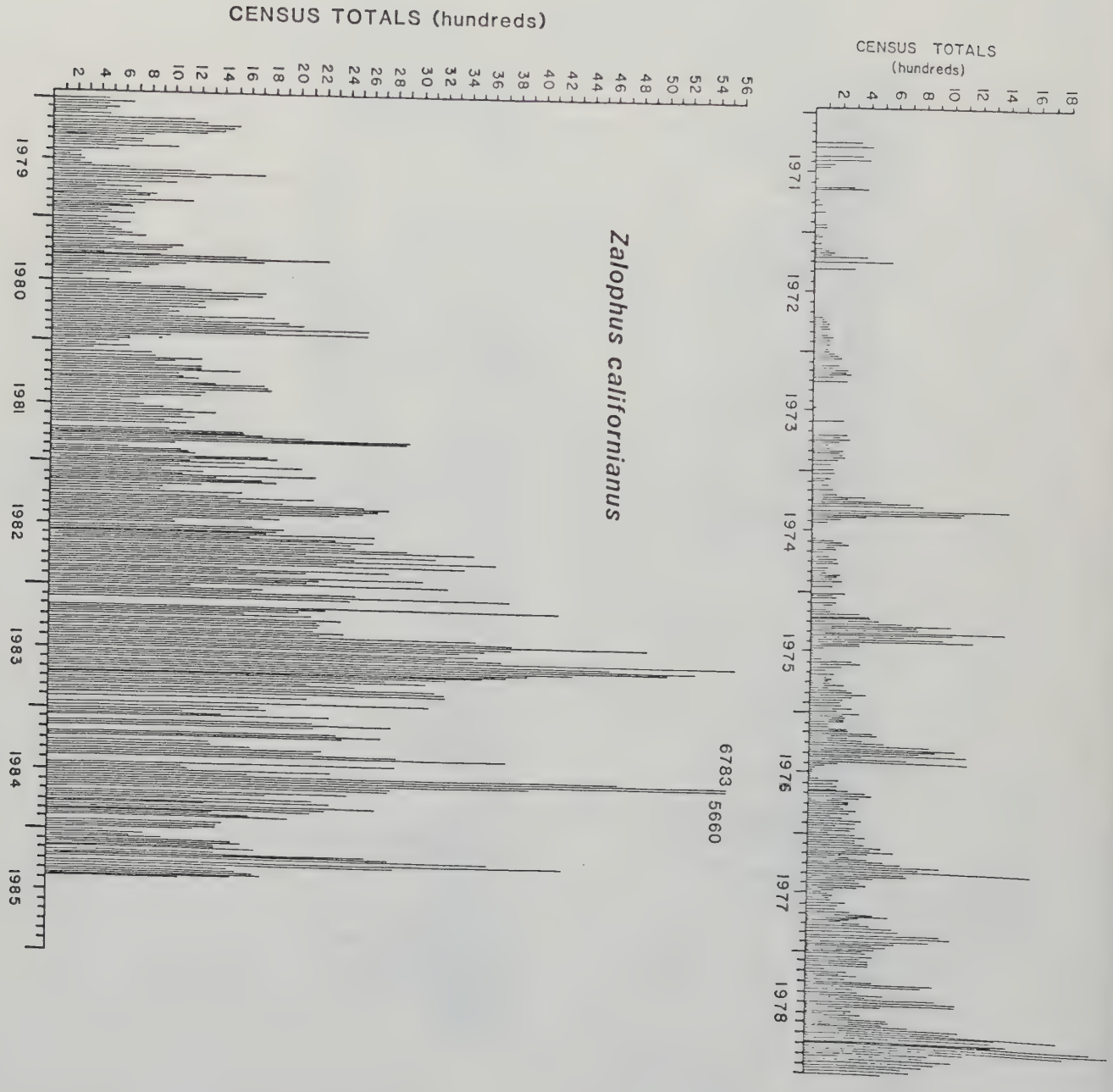


Figure 3. The occurrence of California sea lions (Zalophus californianus) at the Farallones, 1971-1985.

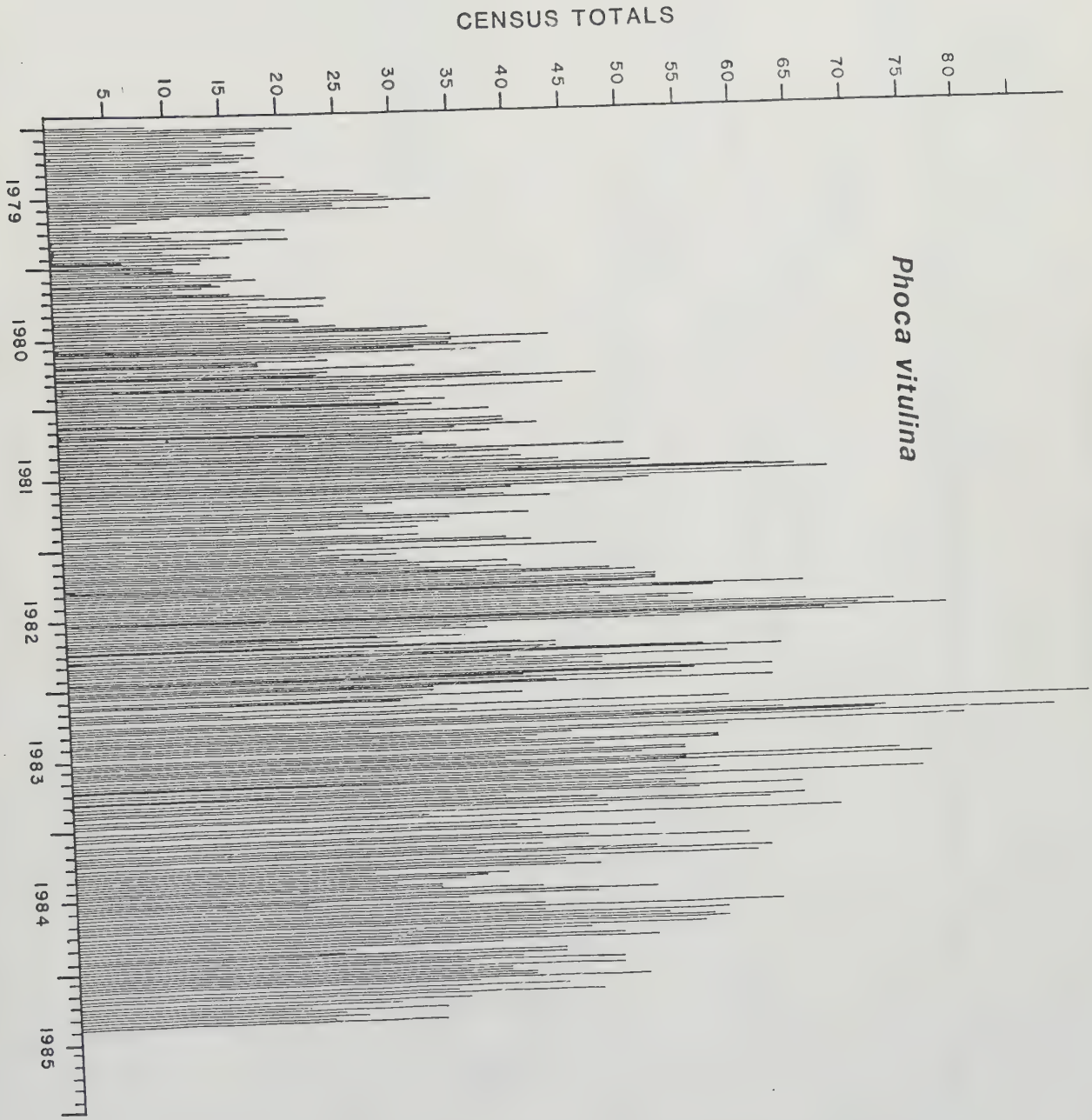


Figure 4. The occurrence of harbor seals (Phoca vitulina) at the Farallones, 1971-1985.

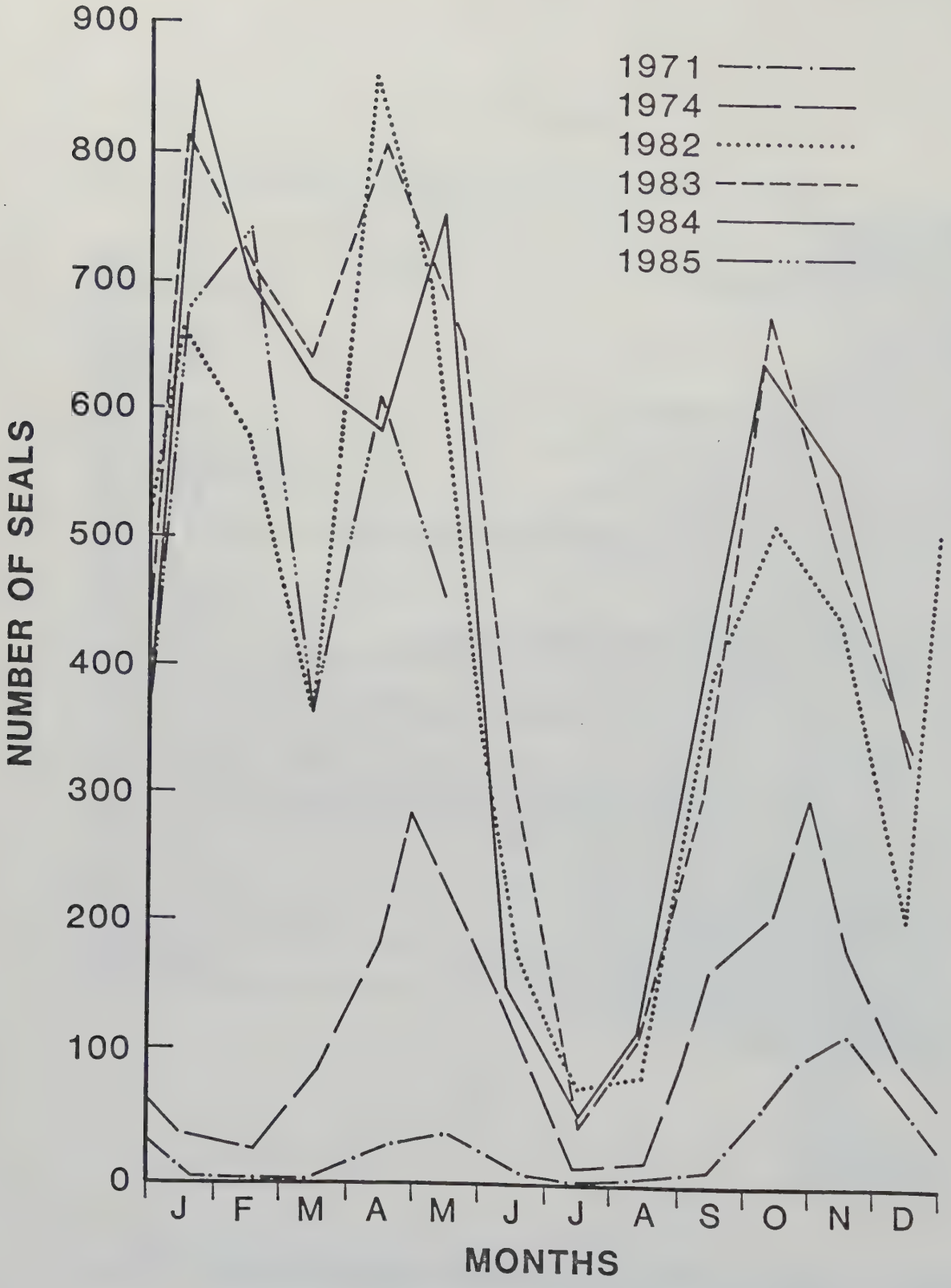
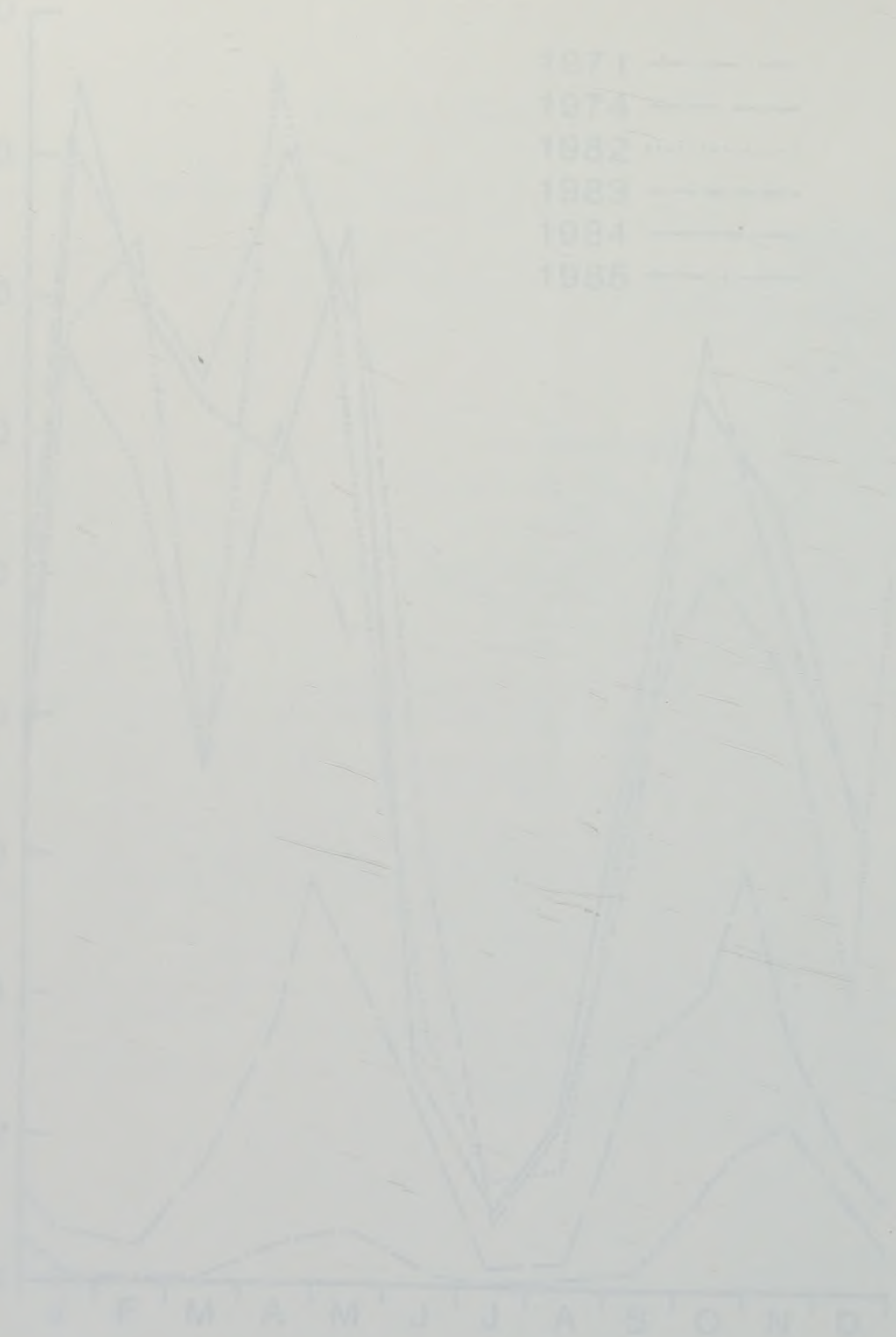


Figure 5. Population fluctuations in elephant seals on South Farallon Islands, 1971-1985.


MONTHS